

Dominance of deep over shallow donors and the non-Debye response of ZnO-based varistors

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Broadband admittance spectroscopy measurements of ZnO-based varistors are analyzed in terms of charge transport theory through double Schottky barriers, hence obtaining empirical evidence on the non-majority of the shallow donor in *n*-type ZnO. The dominant defect species is found to be a deep donor, in agreement with recent first-principles calculations. This result consistently explains the observed frequency-domain non-Debye and time-domain non-exponential electrical response of these materials. Also, it invalidates several assumptions that have been made through the years in the study and characterization of polycrystalline ZnO. We find two deep levels with fine structures, which are attributable to fluctuating chemical environments around the defects.

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